FIGURE AMENDMENTS:

Kindly replace Fig. 1 with the enclosed replacement sheet thereof.

REMARKS

The Examiner has objected to the drawings as not showing the industrial robot of claim 18. In response thereto, a replacement sheet for Fig. 1 has been filed, schematically showing inclusion of a robot 50 cooperating with the laser camera unit 1. Appropriate amendment has also been taken in the specification incorporating the recitation of claim 18 to provide support for figure 1. Review and acceptance is requested.

The Examiner has objected to claim 24 since it should be dependent upon claim 23 in response to which appropriate correction has been taken.

Claims 12-18 and 23-24 stand rejected under 35 USC 103(a) as being unpatentable over Deichmann WO '865 in view of Proesmans '244.

In responding to these rejections, the applicant has amended independent claim 12 to specify that the camera is calibrated in three dimensional space using the known location of the calibration object in conjunction with a determination of the location of the camera relative to the calibration object. Claim 12 also specifies that the location of the laser unit relative to the camera is first determined and the laser is then subsequently calibrated in three dimensional space using the combined information regarding the location of the laser relative to the camera and the previously determined location of the camera in three dimensional space. Claim 23 has been amended in a corresponding fashion. The applicant submits that claims 12 and 23 are distinguished from the prior of record for the following reasons.

The independent claims as amended recite a method for calibrating the camera laser unit relative to a calibration object which is initially disposed

at a known location in three dimensional space. The location of the camera relative to the calibration object is first determined. In so doing, the co-ordinates of the camera are transformed into the three dimensional co-ordinate system of the calibration object. Subsequent thereto, the laser is calibrated with respect to the previously calibrated camera. The laser co-ordinate system is thereby transformed into the image co-ordinate system of the camera. The camera is therefore used to calibrate the laser with respect to the three dimensional co-ordinate system. Support for these changes to the independent claims is given for example on page 5, second paragraph of the original specification. This calibration procedure has decisive advantages over the WO '865 disclosure.

In particular, WO '865 proposes calibration of the camera laser unit relative to a calibration object disposed at a given position and orientation in three dimensional space. Although WO '865 also proposes use of two calibration steps, in contrast in the invention as now claimed, the order of the steps is decidedly different from that as now claimed. In particular, WO '865 proposes an initial step in which the camera is calibrated relative to the laser. In so doing the image co-ordinate system is transformed into the laser co-ordinate system. This calibration step is performed using the well known Tsai algorithm (see WO '865, page 42, first paragraph). At this point in the calibration process, neither the image co-ordinate system nor the laser co-ordinate system is in a defined position in the three dimensional co-ordinate system: neither the absolute position of the image co-ordinate system nor that of the laser co-ordinate system is known relative to the three dimensional co-ordinate system. In a second step, the laser co-ordinate system is calibrated with respect to the three dimensional co-ordinate system thereby allowing both the laser and the camera to be calibrated in three dimensional space (see page 46, beginning of line 5 of the WO '865

disclosure). However, when calibrating the laser with respect to the three dimensional co-ordinate system, the camera information must also be used in order to make and record images of laser light projected on a calibration object. Due to the fact that neither the laser nor the camera are disposed in a known position and orientation with respect to the three dimensional co-ordinate system, the transformation of the relative laser co-ordinate system and of the relative image co-ordinate system to the three dimensional co-ordinate system can only be achieved with complicated algorithms. This results a calibration of the camera laser unit which is cumbersome and time consuming.

In contrast thereto and in accordance with the invention as now claimed, upon completion of the second calibration step in which the laser is calibrated with respect to the previously calibrated camera, both the camera as well as the laser are calibrated in the three dimensional co-ordinate system without requiring any further complicated correlation algorithms. This thereby constitutes a substantial advantage over the disclosure of WO '865 ,in particular, if the calibration is to be done in real time (see page 5, last paragraph of the specification extending to page 6). Therefore the camera-laser triangulation proposal of WO '865 is not suitable for an online tuning process in real time as required, for example, during a manufacturing procedure.

The independent claims recite elements not disclosed by prior art having associated advantages and are therefore sufficiently distinguished from that prior art to satisfy the conditions for patenting in the United States. The dependent claims inherit the limitations of the respective base claim and are therefore similarly distinguished from the prior art of record for the reasons given. Favorable review and passage to issuance is therefore requested.

No new matter has been added in this amendment.

Enclosures:

Replacement sheet of Fig. 1

Respectfully submitted,

Paul Vincent

Dr. Paul Vincent
Reg. No. 37,461

March 16, 2009

Date

Dreiss, Fuhlendorf, Steimle & Becker
Patentanwälte
Postfach 10 37 62
D-70032 Stuttgart
Federal Republic of Germany
Telephone: ++49/711-24 89 38-0
Fax: ++49/711-24 89 38-99